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## ABSTRACT

Medical school admissions committees are expected to select physicians with specific attributes such as intelligence, altruism, dutifulness, and compassion. Besides basing these attributes on the best professional judgment of the physicians and medical school faculty, there has been little quantitative research to determine the psychological factors that predict success as a physician, medical student, or premedical student. It was hypothesized that a combination of preadmission factors and psychological variables would predict academic performance in premedical studies better than preadmission alone. Participants (n=371) were premedical students in a combined bachelor's-M.D. degree program. Preadmission factors were obtained from student records and included high school grade-point averages (GPA), American College Test Composite scores, gender, and racial/ethnic classification. Psychological factors were measured using 40 variables from Cattell's Sixteen Personality Factor Questionnaire, Lanyon's Psychological Screening Inventory, the California Occupational Preference System Inventory, and a modified Thematic Apperception Test. Results show that psychological factors improved the prediction of overall GPA and college science-mathematics GPA. Multiple correlations for the overall GPA increased from .33 using only preadmission variables to .42 when personality variables were added to the analysis. The science-mathematics GPA correlations showed a similar improvement going from .33 to .43 when the psychological factors were added. Contains 22 references. (EMS)

# Evaluation of Psychological Factors in Medical School Admissions Decisions

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## **Evaluation of Psychological Factors in Medical School Admissions Decisions**

The purpose of this study was to determine the effectiveness of preadmission and psychological factors in predicting student performance in a premedical curriculum. Medical school admissions committees are expected to select physicians with specific attributes, such as intelligence, altruism, dutifulness, compassion, etc. (Association of American Medical Colleges, 1998). Whereas these attributes are based on the best professional judgment of physicians and medical school faculty, there has been little quantitative research to determine the psychological factors that predict success as a physician, as a medical student, or as a premedical student. In addition, how can these factors be measured beyond what transpires in a selection interview?

This study is an attempt to launch the process of more comprehensive, longitudinal, quantitative research in the field of medical education by focusing first on success in premedical education. Studies have been conducted to predict performance in college and medical school using a combination of academic and psychological variables, but they have typically focused on a single personality trait or a single instrument rather than covering the broad spectrum of human assessment (Davidson, Beck & Silver, 1999; Lewis, Savickas & Jones, 1996; Mavis & Doig, 1998; Price, 1997; Van Heyningen, 1997; Wang & Newlin, 2000). Varela, Scogin, and Vipperman (1999) have started to validate a structured law enforcement candidate interview, which draws its content from personality screening. This suggests there is value in pursuing the study of personality instruments to be used in other disciplines, such as for the selection of medical students.

The field of human assessment involves three domains: ability, motive, and personality. In selecting students for premedical and medical studies there are also three data sources: life data (applications, grade transcripts, recommendations), question data with conscious presentation (personal statements, interviews, personality questionnaires), and test data without conscious presentation (college entrance exams, projective personality tests). The table below illustrates assessment methods that can be used when evaluating physician candidates (Cattell & Johnson, 1986; Schuerger, 1992).

Table 1  
*Examples of Assessment Procedures by Domain and Data Source*

Data Source	Domain		
	Ability	Motive	Personality
Life	① Grades	④ Personal Statements	⑦ Interviews
Question	② Admission Applications	⑤ COPS	⑧ 16PF, PSI
Test	③ ACT, SAT	⑥ TAT	⑨ Rorschach

*Note:* Table adapted from Schuerger (1992).

The shaded portion of the table (Cells 1,2,3,4,7) indicates areas of assessment that have been well researched in medical education. There is a paucity of medical education research, particularly of a longitudinal and comprehensive nature, for the areas of assessment in the unshaded portion of the above table (Cells 5,6,8,9). The focus of this study will be Cells 5, 6, and 8 with non-threatening psychological assessments that are group-administered

and brief (under two hours total). To assess each individual using a projective test, such as the Rorschach (Cell 9), was considered too time-consuming, costly, and unlikely to yield student participation.

## **Method**

### *Hypothesis*

The medical school admissions process includes screening students first for academics, grade-point averages and test scores. Demographics are also taken into consideration. Then the admissions committee typically takes other factors into consideration, such as psychological characteristics. It was hypothesized that a combination of preadmission factors and psychological variables would predict academic performance in premedical studies better than preadmission factors alone.

### *Participants*

Participants were premedical students in a combined bachelor's-M.D. degree program who matriculated from 1995 through 1998. Their curriculum was a six or seven year program that culminates in the receipt of a bachelor's degree from one of three large state universities and an M.D. degree from the medical school. During their first two or three years, students complete nearly all of their bachelor's degree course work, including science and nonscience courses. Following their premedical studies, students are reviewed to determine their readiness for promotion to medical school. Of the 447 students who entered the combined BS/MD program from 1995 through 1998, 425 (95%) completed all four of the personality instruments during their orientation period. Of these, 371 had college grade-point averages

(GPA) available and were included in this study. Therefore, 81% of the entering students were included in this study. Demographically, there were 199 (54%) males in the study and 172 females (46%). Regarding racial/ethnic backgrounds, there were 185 (50%) Asians, 169 (46%) Caucasians, 15 (4%) African Americans, and 2 (1%) Hispanics.

### *Dependent Variables*

The dependent variables were college overall grade-point average (GPA) and college science-mathematics GPA (BCPM-GPA standing for biology, chemistry, physics, mathematics). Both grade-point averages are taken into consideration when decisions are made about whether or not a premedical student is ready for the academic rigors of medical school. Unlike other medical schools whose students come from a variety of premedical experiences, students in this study attended premedical classes at one of three state universities and took courses of study which were quite similar. The mean college overall GPA for the group of 371 students was 3.50, and the mean BCPM-GPA was 3.31. Previous institutional studies have found only minor differences in GPAs across the three campuses. In other words, a 3.5 GPA at one campus is fairly comparable to a 3.5 at the other two.

### *Independent Variables*

There were two types of independent variables considered in this study: preadmission factors and psychological factors. Preadmission variables were factors used in determining whether or not to admit the student to the combined BS/MD degree program. Psychological factors were the other independent variables that were measured at orientation after the student was accepted into the program.

Preadmission factors were obtained from student records and included high school grade-point averages (GPA), American College Test (ACT) Composite scores, gender, and racial/ethnic classification. The overall high school grade-point average for this group of 371 students was 3.88 with a standard deviation of .23. For the 16 students who did not take the ACT, their Scholastic Aptitude Test (SAT) Total scores were converted using the most recent concordance table (Schneider & Dorans, 1999). The average ACT Composite for the whole group was 28.3 with a standard deviation of 2.2. Only the classifications of Asian and Caucasian were used in the analyses since the other groups were not represented in large enough numbers.

Clearly, high school grades have been the most consistent predictor of college grades. In a study of students in a combined bachelor's – M.D. degree program, high school science GPAs correlated .37 with final college GPAs and high school English/humanities grades correlated .32 (Arnold, Calkins, & Willoughby, 1983). In the same study college aptitude test scores correlated .36 with the college GPA.

Psychological factors were measured using 40 variables from four instruments. Cattell's Sixteen Personality Factor Questionnaire (16PF) assessed adult personality in terms of 16 independent and essentially normal categories or factors. Lanyon's Psychological Screening Inventory (PSI) screened for psychopathological tendencies. The California Occupational Preference System Inventory (COPS) determined satisfaction with doing tasks related to medicine. A modified Thematic Apperception Test (TAT) measured students' personal motivations regarding Achievement, Affiliation, and Power.

Cattell's 16PF is theoretically based in personality psychology and designed to describe a subject's personality as completely as possible in a testing time of approximately

30-45 minutes. As the name suggests, the 16PF relies on the theory that personality has at least 16 independent and psychologically meaningful dimensions.

The Psychological Screening Inventory (PSI), comprised of 130 true or false statements, was administered as a quick screen for psychopathological tendencies. These statements result in scores on five (5) scales: Alienation, Social Nonconformity, Discomfort, Expression, and Defensiveness (Lanyon, 1978). A preliminary study of a sample of students in this study found that instances of psychological pathology were the exception, not the rule, and occurred less frequently than in the general student population (Schuerger, Jones, Newman, & Seeman, 1992).

The California Occupational Preference System Inventory (COPS), based on Holland's congruence principle (Holland, 1973), asks subjects to respond to how much they like or dislike 168 job activity descriptions. Profiles are developed that compare examinees in each of 14 occupational interest clusters, including the cluster covering physician: Professional, Science (Knapp, Knapp, & Knapp-Lee, 1990).

In contrast to the self-report nature of the 16PF, the PSI, and the COPS, the modified Thematic Apperception Test (TAT) was included in the test battery as an open-ended method of measuring students' personal motivations. After being shown six pictures of people in various situations, students were given four minutes to write a story about each picture. Each story written by all students in this study for all four years was scored by a single, trained professional, who used standard procedures for scoring the motives of Achievement, Affiliation, and Power (Atkinson & Birch, 1978; McClelland, 1985; Murray, 1949).



## *Data Analysis*

Stepwise multiple regression analyses were performed to predict college overall GPAs and college BCPM-GPAs from preadmission factors alone and then in combination with psychological factors.

## **Results**

Results of the multiple regressions predicting the dependent variables of college overall GPA and college science-mathematics GPA are summarized in Tables 2-5. For both the overall GPA and the BCPM-GPA, including psychological factors in the analyses improved the prediction. Multiple correlations for the overall GPA increased from .33 using only preadmission variables to .42 when personality variables were added to the analysis. The BCPM-GPA correlations showed a similar improvement going from .33 to .43 when the psychological factors were added. For both GPAs the explained variance increased by 7%. The personality factors that accounted for the increase in the explained variance for both GPAs were: 16PF Factor N – Shrewdness, COPS – Technology, Skilled, and PSI – Defensiveness. For the BCPM-GPA, 16PF Factor F – Impulsivity also added significantly to the prediction. Neither gender nor racial/ethnic classification entered the predictions of college grades. The three TAT motive scores also did not significantly add to the prediction of the premedical GPAs.

Table 2

*Stepwise Multiple Regression Analysis Predicting College Overall Grade-Point Average with Preadmission Variables (N=371)*

Variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>R</i> <sup>2</sup> Change	<i>F</i>	<i>p</i>
High School GPA	.30	.09	.09	36.19	.00
ACT Composite	.33	.11	.02	23.23	.00

*Note.* Because of rounding, values in the *R*<sup>2</sup> change column can be .01 greater or lesser than the changes in the *R*<sup>2</sup> column suggest.

Table 3

*Stepwise Multiple Regression Analysis Predicting College Overall Grade-Point Average with Preadmission and Psychological Variables (N = 371)*

Variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>R</i> <sup>2</sup> Change	<i>F</i>	<i>p</i>
High School GPA	.30	.09	.09	36.19	.00
16PF Factor N-Shrewdness	.36	.13	.04	26.56	.00
COPS-Technology, Skilled	.39	.15	.03	21.70	.00
ACT Composite	.41	.17	.02	18.47	.00
PSI-Defensiveness	.42	.18	.01	15.83	.00

*Note.* Because of rounding, values in the *R*<sup>2</sup> change column can be .01 greater or lesser than the changes in the *R*<sup>2</sup> column suggest.

Table 4  
*Stepwise Multiple Regression Analysis Predicting College Science/Mathematics Grade-Point Average with Preadmission Variables (N=371)*

Variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>R</i> <sup>2</sup> Change	<i>F</i>	<i>p</i>
High School GPA	.29	.09	.09	34.68	.00
ACT Composite	.33	.11	.02	22.26	.00

*Note.* Because of rounding, values in the *R*<sup>2</sup> change column can be .01 greater or lesser than the changes in the *R*<sup>2</sup> column suggest.

Table 5  
*Stepwise Multiple Regression Analysis Predicting College Science/Mathematics Grade-Point Average with Preadmission and Psychological Variables (N = 371)*

Variable	<i>R</i>	<i>R</i> <sup>2</sup>	<i>R</i> <sup>2</sup> Change	<i>F</i>	<i>p</i>
High School GPA	.29	.09	.09	34.68	.00
16PF Factor F-Impulsivity (negative loading)	.35	.12	.03	25.05	.00
ACT Composite	.37	.14	.02	19.53	.00
16PF Factor N-Shrewdness	.40	.16	.02	16.90	.00
COPS-Technology, Skilled	.41	.17	.01	14.80	.00
PSI-Defensiveness	.43	.18	.01	13.41	.00

*Note.* Because of rounding, values in the *R*<sup>2</sup> change column can be .01 greater or lesser than the changes in the *R*<sup>2</sup> column suggest.

## Discussion

The high school GPA and ACT scores continue to be the most useful in predicting premedical grades, even in this academically homogeneous group, accounting for 11% of the explained variance. It is obvious that any medical school admissions committee must take academics into consideration when selecting future physicians. However, these factors still leave 89% of the variance in student premedical performance unexplained, leaving plenty of room for consideration of additional factors in the selection process.

In addition to the academic factors, the four psychological factors which added to the prediction of premedical grades were scores that measured Shrewdness and Impulsivity on the 16PF, scores that indicated an interest in Technology, Skilled career areas, and scores indicating defensiveness in taking the PSI.

The 16PF Factor Shrewdness, which is a measure of socialization, behavior control, and sophistication added about 4% to the explained variance for the overall GPA and 2% for the BCPM-GPA. Our students as a group had a mean of 8.61 (S.D. = 2.94) on this factor which is close to the college student norm of 8.75 (S.D. = 2.80). Students high on this factor had higher GPAs than those low in this characteristic. Words used to define the high end of Shrewdness on the 16PF are “polished, socially aware, diplomatic, calculating,” whereas words describing those low in this factor are “forthright, unpretentious, open, genuine” (IPAT Staff, 1991, p. 29). This suggests that students whose feelings were not easily swayed and who may have more difficulty responding emotionally received somewhat higher grades than those who had a natural warmth and liking for people. In order to cope with the suffering and grief related to illness, physicians need the ability to detach emotionally from their patients, but they also need to display compassion to those who are going through trauma. Therefore, it will be important to study this factor as a predictor of grades in the later medical school years when warmth and caring become important in dealing one-on-one with patients.

The 16PF Factor Impulsivity, which is a measure of seriousness, added about 3% to the explained variance in the BCPM-GPA but did not enter into the equation for predicting the overall GPA. Persons low on the Impulsivity factor are typically introspective, cautious, and reflective people who have difficulty revealing themselves to others (IPAT Staff, 1991).

Considering that many college science courses taken by premedical students are lecture-based and do not require much interaction with the instructor, students low in this factor are likely to have an advantage in these courses. On the other hand, non-science/mathematics courses may require more class discussion, self-revelation, and personal sharing and may be why this factor is not a predictor of the overall college GPA, which includes courses in the humanities and social sciences. It will be necessary to follow the students through their curriculum regarding this characteristic, because other courses in medical school require the reverse end of this factor. Students high in the opposite end of this characteristic are described as being cheerful and enthusiastic people. These are characteristics that could give them the edge in handling clerkships, especially in internal medicine, pediatrics, and family medicine, which require intensive personal contact with patients and staff. However, it has been found that sometimes these overly enthusiastic people can be impulsive and inattentive to detail, making them risky to work with (Schuerger, 1998).

It is interesting that the COPS factor Technology, Skilled was predictive of premedical grades considering that these students are all on the track to become physicians, which is in the COPS occupational cluster Professional, Science. In fact 90% of the group scored above 20 out of 36 possible on the Professional, Science cluster, and it had the highest mean of all the career clusters at a 27. In contrast, only 10% of the students scored above a 20 on the Technology, Skilled career cluster, which had the lowest group mean next to the Clerical cluster. The jobs in the Technology, Skilled cluster are occupations involving a skilled trade and working with one's hands, such as constructing, installing or repairing electronic and mechanical devices (Knapp, Knapp, & Knapp-Lee, 1990). It appears that students high in the Professional, Science cluster had already self-selected into the program

or were selected through the interviewing process. The subset of students who are interested in working with their hands may also be the ones who perform well in science laboratory courses that require those skills to operate the equipment and follow the “cookbook” experiments. As this longitudinal study progresses, it is hypothesized that they may also be the students who decide to enter the more technology-oriented specialties in medicine, such as surgery.

The last variable that was significant in predicting the overall GPA and the BCPM-GPA was the Defensiveness scale on the PSI. The mean for our students on this scale was 11.17 (S.D. = 2.62), which indicates that they were not “faking good” or “faking bad” as a group on the instrument. Technically, Defensiveness in this context merely refers to the mindset the student had in taking the test and does not necessarily indicate a distrustful or self-protective personality characteristic (Lanyon, 1978). However, it is clear that students who wanted to present themselves in the best light on the PSI, scoring higher than the rest on Defensiveness, had some advantage in getting better grades in their premedical studies. Perhaps this mindset carried over into how they present themselves to anyone who is evaluating them, including their college professors. Because students high on this score are also reluctant to admit any undesirable characteristics, it would be interesting to study whether those who have difficulties during their medical careers seek help for their problems.

Two final observations are warranted. First, in spite of having over 40 psychological variables, only four added significantly beyond the academic factors to the prediction of premedical grades. Adding the four psychological variables into the prediction models increases the explained variances to 18%, still leaving 82% unexplained. Even though this study attempted to be more comprehensive in assessing psychological factors, we still have

much to learn and study to determine what factors predict success in medicine. Secondly, the medical education continuum has multiple hoops for a student to jump through before he or she becomes a practicing physician. Although the psychological variables identified as predictive of success in premedicine may carry over as predictors of success in the first two years of medical school, they might not be the same ones to predict success in the clerkship years. Before any recommendations for medical student selection can go forward, more studies must be done to track these students' progress during their four years of medical school, through their three to eight years of medical residency, and even throughout their years of medical practice. These longitudinal studies will hopefully bring into focus the combination of factors that make for physician success over the entire medical education continuum, not just in premedicine as this study did. Therefore, the challenge remains for admissions committee members to select students who will do well not only in the basic science curriculum, but also on the hospital wards and in their private offices when dealing with patients and their families.

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